WATER RESOURCES REVIEW for NOVEMBER 1976

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

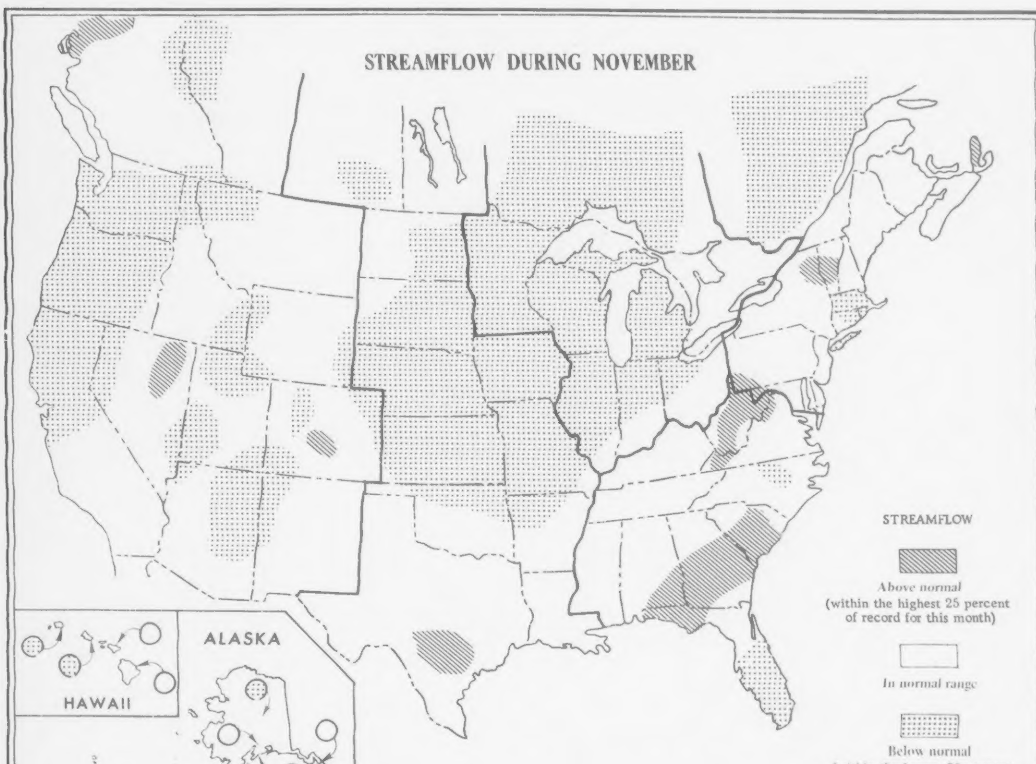
STREAMFLOW AND GROUND-WATER CONDITIONS

Streamflow generally decreased in large areas of southern Canada, Alaska, Colorado, and most of the Eastern United States, but increased seasonally in several Southern and Western States.

Flows in the below-normal range persisted in many North-Central and Western States and decreased into that range in several New England States and parts of Florida, North Carolina, most of Oregon, as well as in Quebec and Alberta.

Above-normal flows prevailed in Georgia and parts of adjacent States as well as in parts of British Columbia, Colorado, Nevada, New York, Nova Scotia, Texas, Vermont, and West Virginia.

Monthly mean flows were lowest of record for November in parts of Iowa, Michigan, South Dakota, Utah, and Wisconsin.



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NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

Streamflow generally decreased contraseasonally throughout the region except for the Atlantic Provinces and parts of Maine, Maryland, and Quebec. Monthly mean flows remained in the above-normal range in parts of New York, Nova Scotia, Pennsylvania, and Vermont. Monthly mean discharges were in the below-normal range in parts of Connecticut, Massachusetts, New York, Rhode Island, and Quebec.

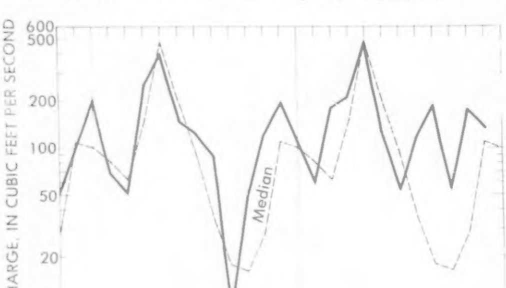
In New Jersey and Pennsylvania, monthly mean flows decreased contraseasonally and were in the normal range except in Monongahela River at Braddock, Pa., where high carryover flow from October held the mean discharge in the above-normal range.

Similarly, streamflow in New York decreased contraseasonally and was in the normal range except in Hudson River at Hadley, where high carryover flow from October held the monthly mean discharge in the above-normal range for the 10th consecutive month. On Long Island, flow of Massapequa Creek at Massapequa decreased and was in the below-normal range.

In eastern Connecticut, Rhode Island, and Massachusetts, where monthly mean flows normally increase in November, flows decreased into the below-normal range and were about one-half the November median flows. For example, the monthly mean discharge of Branch River at Forestdale, R. I. (drainage area, 91.2 square miles) was 63 cfs and only 55 percent of median.

In Vermont, flow at the index station, White River at West Hartford, decreased but remained in the above-normal range for the 5th consecutive month.

Streamflow in Maine decreased into the normal range at all index stations. In the southern part of the State, monthly mean discharge at Little Androscoggin River, near South Paris, decreased contraseasonally and was above the median discharge for the 5th consecutive month but within the normal range. (See graph.)

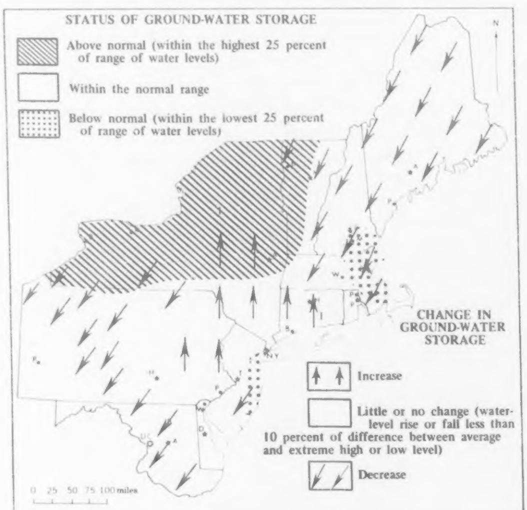


Monthly mean discharge of Little Androscoggin River near South Paris, Maine (Drainage area, 76.2 sq mi; 197 sq km)

Monthly mean flows in the Atlantic Provinces were generally in the normal range except at Northeast Margaree River at Margaree Valley, Nova Scotia, where streamflow increased seasonally and was in the above-normal range for the 2d consecutive month.

North of the St. Lawrence River, in Quebec, monthly mean flows at all index stations decreased and were generally in the below-normal range.

Ground-water levels declined in most of northern and central New England as well as in central Pennsylvania, coastal areas of New Jersey, and in most of Maryland. (See map.) Levels rose in east-central New York State, eastern Pennsylvania, and in central and northwestern parts of Connecticut. Levels near end of month remained above average in most of New York State; and were below average in east-central New Jersey, southeastern New Hampshire, and parts of eastern Massachusetts. Elsewhere, levels were generally within the normal range of levels for end of November.



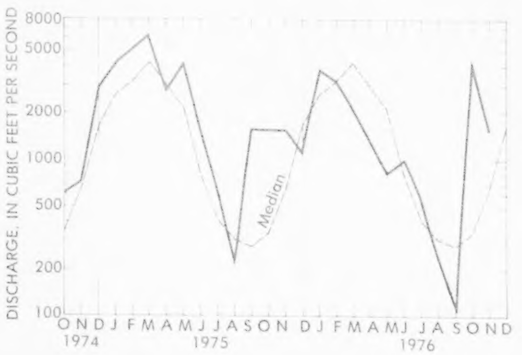
Map shows ground-water storage near end of November and change in ground-water storage from end of October to end of November.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow decreased contraseasonally in North Carolina, Virginia, and West Virginia; increased seasonally in Alabama, Kentucky, and Mississippi; and was variable in all other States in the region. Flows remained in the above-normal range at some index stations in each State, except Kentucky, North Carolina, Mississippi, and Tennessee. Monthly mean flows were in the below-normal range in parts of Florida and North Carolina.

In West Virginia, high carryover flow from October, resulted in a contraseasonal decrease in the monthly mean flows at all index stations and flows generally remained in the above-normal range. However, monthly mean discharge in Greenbrier River at Alderson decreased from the record high October flow to less than 2.5 times the median, but was within the normal range. (See graph.)



Monthly mean discharge of Greenbrier River at Alderson, W. Va.
(Drainage area, 1,357 sq mi; 3,515 sq km)

Streamflow in Virginia was in the normal range except at North Fork Holston River near Saltville, where high carryover flow from October held monthly mean discharge in the above-normal range for the 2d consecutive month.

In north-central North Carolina, mean flow of Neuse River near Clayton (drainage area, 1,140 square miles) decreased contraseasonally to about 50 percent of median and was in the below-normal range.

In South Carolina, streamflow was in the above-normal range as a result of high carryover flow from flooding in October. Monthly mean discharge at the index station, Lynches River at Effingham, increased seasonally and remained in the above-normal range at 2 times the median flow.

In Georgia, no major flooding was reported as a result of heavy rains that occurred near the end of the month. Streamflow at the index station, Alapaha River at Statenville, increased contraseasonally to nearly 8 times the median and remained in the above-normal range.

In the Apalachicola River basin in western Georgia and the adjacent areas of southeastern Alabama and northwestern Florida, monthly mean discharge as measured at Chattahoochee, Florida, increased contraseasonally and remained in the above-normal range. In west-central Florida, mean flow of Peace River at Arcadia continued to decrease seasonally, was only 44 percent of median, and below the normal range.

In southeastern Alabama, monthly mean flow of Conecuh River at Brantley increased seasonally to over 2 times the median flow and into the above-normal range. Elsewhere in the State, flows were in the normal range.

Ground-water levels rose in the northern panhandle of West Virginia and in the southwestern third of the State, but declined elsewhere; levels were generally above average except in a few southeastern counties, in Wayne County in the west, and in parts of the eastern panhandle. Levels generally declined seasonally but were above average in most areas in Kentucky. In Virginia, the level in the key well near Petersburg rose slightly in response to precipitation near the end of the month, and there was recovery also in wells in northeastern Surry County, in southeastern Virginia, in response to reduced industrial pumping. In the key well in the Memphis area in western Tennessee, a new low level was noted for November, in 23 years of record. In North Carolina, levels rose and were above average in the mountains, declined but were above average in the Piedmont, and declined and were below average in the Coastal Plain. At the coastal city of Georgetown, in South Carolina, ground-water levels have been rising as a result of conversion to a surface-water supply in late spring. In Mississippi, ground-water levels rose in the shallow Mississippi River alluvium in the northwestern part of the State, and rose also in wells screened in the Sparta Sand in the Jackson area; levels in the Sparta in the Jackson area have declined about 1 to 2 feet since a year ago. In central Alabama, artesian pressures rose in the index well in Montgomery but continued to decline in Centreville; levels continued above average. In Georgia, ground-water levels in most wells in the Piedmont area continued their seasonal decline, but did not reflect as much change as in previous months because of heavy rainfall during the month. In the Savannah area on the coast, levels in and near the center of pumping were about the same as last month, but ranged from 3 to 8 feet lower than last year, when levels were high because of temporary reduction of industrial pumping. In the outlying area, levels were about the same as last month, but ranged from 2 to 3 feet lower than last year. In Bryan and Liberty Counties south of Savannah, levels were about the same as last month, but were about 2 feet lower than last year. In the Brunswick area still farther south, levels in and near the center of pumping ranged up to 3 feet higher than last month and were slightly higher than last year. In the outlying area of Brunswick, levels were about the same as last month and about 2 feet lower than last year. In Florida, ground-water levels rose in the northern part of the State, but declined in central peninsular and southern Florida. End-of-month levels ranged from 0.2 to 3.0 feet above

those of October in northern, northwestern and northeastern Florida; and in central peninsular Florida from 0.1 foot below to 3.65 feet below those of last month. End-of-month levels ranged from 13.7 feet above average north of Tallahassee to 10.8 feet below average near Mulberry in west-central Polk County. In southeastern Florida, levels generally declined during the month except in isolated areas. End-of-month levels ranged from about average to 2.3 feet below average.

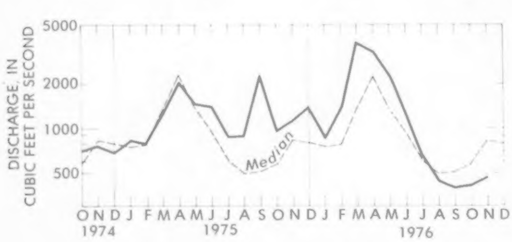
WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow generally increased seasonally throughout the region except in parts of Illinois, Ohio, and Michigan. Monthly mean flows remained below the normal range in the northern part of the region and decreased into that range in large areas of Illinois, Indiana, and Ohio. Monthly mean flows were lowest of record in parts of Michigan and Wisconsin.

In Wisconsin, streamflow increased seasonally at all index stations but remained in the below-normal range. The November monthly mean discharge of 36.1 cfs at Jump River at Sheldon (drainage area, 574 square miles) was lowest in 60 years of record. Similarly, the monthly mean flow of 2,871 cfs in Wisconsin River at Muscoda (drainage area, 10,300 square miles) was lowest for period of record that began in 1913. Streamflow in the Chippewa River basin remained near record low for November.

Similarly, in Michigan's Upper Peninsula, the monthly mean discharge of 16.8 cfs at the index station, Sturgeon River near Sidnaw (drainage area, 171 square miles) was only 10 percent of median and a new monthly minimum for the 5th consecutive month. Streamflow in Michigan's Lower Peninsula was also in the below-normal range where the mean flow of Muskegon River at Evart (although increasing seasonally) remained in the below-normal range for the 3d consecutive month. (See graph.)



Monthly mean discharge of Muskegon River at Evart, Mich. (Drainage area, 1,450 sq mi; 3,760 sq km)

In Ohio, streamflow returned to the normal range in eastern and central sections of the State and decreased contraseasonally into the below-normal range in the Maumee River basin.

In Indiana, where monthly mean discharge in Mississinewa River at Marion had been in the normal range, flows increased but were in the below-normal range in November. Monthly mean flows in the Wabash River and East Fork White River were augmented by reservoir releases and were in the normal range.

Streamflow at all index stations in Illinois was in the below–normal range. The monthly mean discharge of 6.75 cfs in Sangamon River at Monticello (drainage area, 550 square miles) was 13 percent of the November median and only 23 percent greater than the minimum November mean of 5.5 cfs observed in 1914.

In Minnesota, streamflow continued in the below-normal range except for the northwest and southeast corners of the State. Flows at all index stations increased slightly and were generally less than 40 percent of median as the drought in Minnesota continued.

In southwest Ontario, mean flow in English River at Umfreville increased contraseasonally but remained in the below-normal range for the 6th consecutive month.

Ground-water levels in shallow water-table wells in Minnesota declined and remained below average. The level in the key well near Hanska, in south-central Minnesota, was the lowest for November in 34 years of record. In the Minneapolis-St. Paul area, artesian levels continued to rise in wells tapping the Prairie du Chien-Jordan aquifer and the deeper Mt. Simon-Hinckley aquifer; both were below average. In Wisconsin, levels continued to decline and were near or slightly below average. Levels in Michigan generally declined during the month, and were below average except in the southern part of the Lower Peninsula. The level in the shallow well at Princeton, in northwestern Illinois, having risen during October, declined in November again, continuing the general trend that began in May 1976; however, the level was still about a foot above average near the end of the month. In Indiana, levels declined rapidly during the first half of the month and then remained well below normal. Levels in Ohio declined in the central and northeastern parts of the State, but remained about average.

MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

Streamflow increased seasonally in Arkansas, Louisiana, and Nebraska and was variable elsewhere in

(Continued on page 6.)

Provisional data: subject to revision

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations above mean sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.)

Lake	November 30, 1976	Monthly mean, November		November		
		1976	1975	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	600.17	600.33	601.20	600.82	601.81 (1974)	599.17 (1925)
Michigan and Huron (Harbor Beach, Mich.)	578.58	578.82	579.49	578.05	580.20 (1973)	575.57 (1964)
St. Clair (St. Clair Shores, Mich.)	573.88	574.06	574.70	572.92	575.18 (1972)	570.83 (1934)
Erie (Cleveland, Ohio)	571.00	571.19	571.68	569.84	572.17 (1972)	567.60 (1934)
Ontario (Oswego, N.Y.)	244.10	244.46	244.24	244.06	246.18 (1945)	241.45 (1934)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	November 30, 1976	November 30, 1975	Reference period 1904–75		
			November average, 1904–75	November maximum (year)	November minimum (year)
Elevation in feet above mean sea level:	4,200.35	4,200.25	4,197.6	4,204.1 (1923)	4,191.7 (1963)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

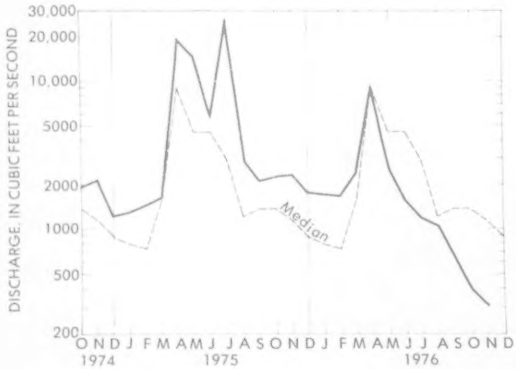
Alltime high (1827–1975): 102.1 (1869). Alltime low (1939–1975): 92.17 (1941).	November 29, 1976	November 30, 1975	Reference period 1939–75		
			November average, 1939–75	November max. daily (year)	November min. daily (year)
Elevation in feet above mean sea level:	96.46	97.75	94.65	97.61 (1946)	93.12 (1954)

FLORIDA

Site	November 1976		October 1976	November 1975
	Discharge, in cfs	Percent of normal	Discharge, in cfs	Discharge, in cfs
Silver Springs near Ocala (northern Florida)	760	90	800	690
Miami Canal at Miami (southeastern Florida)	290	112	320	250
Tamiami Canal outlets, 40-mile bend to Monroe	62	30	553	95

(Continued from page 4.)
the region. Monthly mean flows were in the below-normal range in parts of all States except Louisiana and Texas. Above-normal flows persisted in parts of Texas while record low flows occurred in parts of Iowa and South Dakota.

In North Dakota, drought conditions continued as a result of no significant precipitation for the 2d consecutive month. The very dry conditions were reflected in the monthly mean discharge of Red River of the North at Grand Forks which decreased seasonally and remained in the below-normal range for the 3d consecutive month. (See graph.) In the southwestern part of the State, ground-water inflow enabled the Cannonball River at Breien to slip into the normal range.



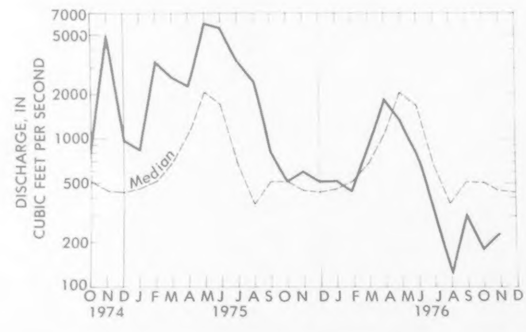
Monthly mean discharge of Red River of the North at Grand Forks, N. Dak. (Drainage area, 30,100 sq mi; 78,000 sq km)

Below-normal flows persisted in South Dakota where the monthly mean discharge of Bad River near Fort Pierre remained at zero for the 5th consecutive month. Also in eastern South Dakota, streamflow increased contraseasonally and the monthly mean discharge of 45.4 cfs in Big Sioux River as measured at Akron, Iowa (drainage area, 9,030 square miles) was less than 20 percent of the median and lowest for period of record that began in 1928.

In Iowa, monthly mean discharge in Des Moines River at Fort Dodge increased contraseasonally but remained in the below-normal range for the 8th consecutive month and lowest of record for November. Streamflow elsewhere in the State was generally in the below-normal range as a result of much below-normal precipitation and below-normal temperatures.

In Nebraska, Kansas, and Missouri, streamflow was in the below-normal range at all index stations. The monthly mean discharge at Elkhorn River at Waterloo, Nebraska, was 50 percent of median and in the below-normal range for the 6th consecutive month. In southern Missouri and the adjacent areas of northern Arkansas, monthly mean discharges remained in the below-normal range and were about 50 percent of the November median flows.

Streamflow in Oklahoma was generally below median during November where runoff conditions were indicating a low-flow cycle for the winter months. For example, the monthly mean flow in Washita River near Durwood increased contraseasonally into the normal range but remained below the median flow for the 7th consecutive month. (See graph.)



Monthly mean discharge of Washita River near Durwood, Okla. (Drainage area, 7,202 sq mi; 18,653 sq km)

Runoff was above the normal range in southern Texas in the Guadalupe and lower Nueces River basins and in several streams near San Angelo. For example, monthly mean flow at the index station, Guadalupe River near Spring Branch (drainage area, 1,315 square miles) increased seasonally to 424 cfs and was nearly 4 times the median flow for November. Flows elsewhere in Texas were generally in the normal range.

In Manitoba, the level of Lake Winnipeg at Gimli averaged 712.31 feet above mean sea level for the month, 1.09 feet below the long-term mean. The maximum level for November occurred in 1948 and was 716.48 feet; the minimum monthly mean of 710.19 feet occurred in 1940.

Ground-water levels were variable in most of the region except in Texas, where rises were noted in many wells. In North Dakota, levels stabilized somewhat but remained at or near record lows; a new low for November, and a new low for 13 years of record was noted in the well at Wyndmere in the eastern part of the State. Levels generally rose throughout most of Nebraska; at month's end, levels were higher than last year, except in the northwestern part of the State, where levels declined in response to heavy pumping for irrigation and municipal supplies. Levels in Iowa

generally declined across the State in response to continued below-normal precipitation; a second new record low occurred in the well in Linn County in east-central Iowa. In Kansas, levels generally declined and were below average; the level in the key well in Lawrence in the eastern part of the State continued near the record end-of-month low. Slight rises were noted in areas where irrigation has recently been reduced. In the rice-growing area of east-central Arkansas, the water level in the shallow aquifer was unchanged and was in the same range that has prevailed since 1955. In the industrial aquifer of central and southern Arkansas—the Sparta Sand—the level in the key well at Pine Bluff fell slightly; it was 9 feet below average but 1¼ feet higher than a year ago. At El Dorado, in the same aquifer, the level rose nearly 4 feet and was slightly above average, and 21 feet higher than in November 1965. In Louisiana, levels declined in the Sparta Sand in the northern part of the State, declined in the Miocene and terrace aquifers in the central part, and also in the "2,000-foot sand" of the Baton Rouge area. Levels rose in the Chicot aquifer in southwestern Louisiana and in most of the aquifers in the southeast including those in Baton Rouge and New Orleans. In Texas, levels rose and were above average in key observation wells in the Edwards Limestone at Austin and San Antonio, and rose but were below average in the bolson deposits at El Paso. Despite the slight rise at El Paso, a new November low was noted in 19 years of record.

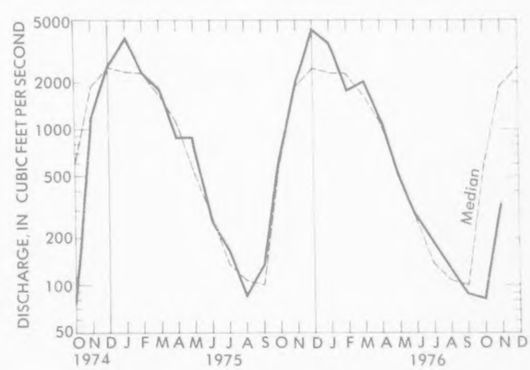
WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

Streamflow generally decreased in Alberta, British Columbia, Colorado, Idaho, and Montana, but was variable in all other States in the region. Flows remained in the above-normal range in parts of British Columbia, Colorado, and Nevada. Monthly mean discharges remained in the below-normal range in parts of Arizona, California, Montana, Oregon, Utah, and Washington, and decreased into that range in parts of Alberta and Colorado. Record-low flows occurred in parts of Utah.

Streamflow in western Washington continued in the below-normal range for the 2d consecutive month. Monthly mean discharge at Chehalis River near Grand Mound in southwestern Washington was only 15 percent of median; this was only the third month since April 1973 that the flow there has been in the below-normal range. National Weather Service reports indicate that precipitation during November in western Washington was lowest since 1880. The mountain snowpack was almost non-existent and public and private utilities as well as others dependent on reservoir and snow storage for water supply and hydroelectric power were becoming increasingly concerned.

Similarly, streamflow in Oregon was in the below-normal range as a result of below-normal precipitation. For example, monthly mean discharge at the index station, Wilson River near Tillamook, in northwestern Oregon, increased seasonally, but remained in the below-normal range for the 2d consecutive month and was only 18 percent of median. (See graph.)



Monthly mean discharge of Wilson River near Tillamook, Oreg. (Drainage area, 161 sq mi; 417 sq km)

In northern California, streamflow was also in the below-normal range and the monthly mean flow of 391 cfs in Smith River near Crescent City (drainage area, 609 square miles) increased seasonally but was only 9 percent of the November median flow. The remaining index stations in northern California had mean flows in the below-normal range that reflected a continuation of the severe drought during the previous water year. Contents of the eleven major reservoirs were only 70 percent of average and 59 percent of the storage at the end of November 1975.

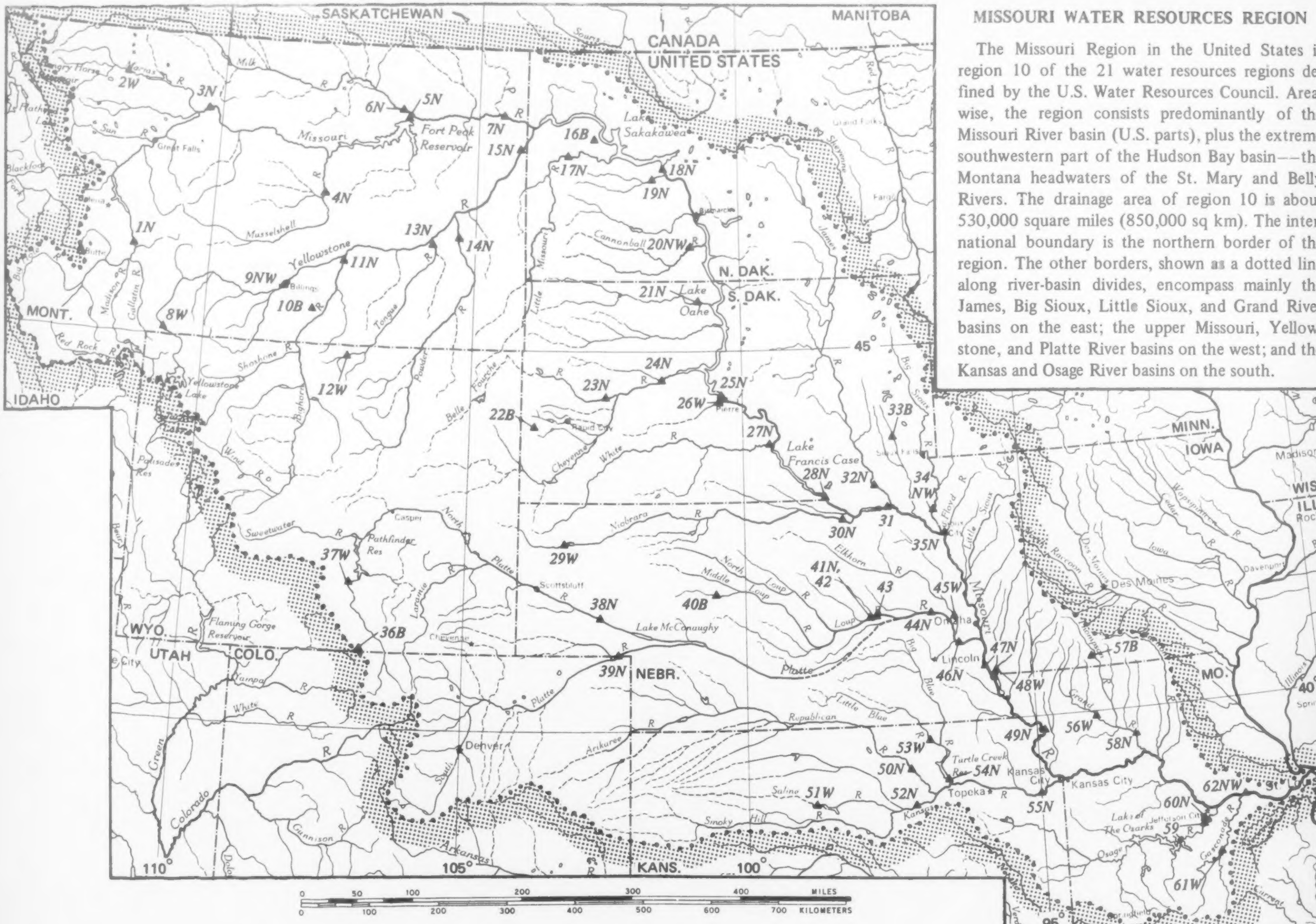
In northeastern Nevada, monthly-mean discharge in Humboldt River at Palisade increased seasonally and remained in the above-normal range for the 3d consecutive month.

In northwestern Arizona, mean flow of Virgin River at Littlefield decreased contraseasonally and was below the normal range in November. In northeastern Arizona, monthly mean discharges at Little Colorado River near Cameron and Salt River near Roosevelt decreased seasonally and were in the below-normal range. In southeastern Arizona, mean flow of Gila River at head of Safford Valley, near Solomon, increased seasonally to 73

(Continued on page 10.)

MISSOURI WATER RESOURCES REGION

The Missouri Region in the United States is region 10 of the 21 water resources regions defined by the U.S. Water Resources Council. Areawise, the region consists predominantly of the Missouri River basin (U.S. parts), plus the extreme southwestern part of the Hudson Bay basin—the Montana headwaters of the St. Mary and Belly Rivers. The drainage area of region 10 is about 530,000 square miles (850,000 sq km). The international boundary is the northern border of the region. The other borders, shown as a dotted line along river-basin divides, encompass mainly the James, Big Sioux, Little Sioux, and Grand River basins on the east; the upper Missouri, Yellowstone, and Platte River basins on the west; and the Kansas and Osage River basins on the south.



SELECTED DATA FOR SOME KEY STREAM STATIONS IN THE MISSOURI REGION

The stream stations listed below include, for this region, all sites presently in the National Stream Quality Accounting Network (NASQAN), all Geological Survey hydrologic bench-mark stream-gaging stations; all U.S. river stations of the International Hydrological Decade (IHD, 1965–74), and all U.S. index and large-river stations that are used each month in compiling the Water Resources Review. Streams are listed in downstream order, generally proceeding from west to east.

The map number identifies NASQAN sites by "N," the hydrologic bench-mark stations by "B," and Water Resources Review stations by "W." The IHD stations are those with map numbers 7N, 15N, 31, 46N, 47N, 55N, and 62NW. Of the 38 NASQAN ("N") stations, radiochemical sampling is carried out at stations 9N, 39N, and 47N, and pesticide sampling at stations 1N, 3N, 4N, 7N, 9N, 15N, 17N, 21N, 24N, 27N, 32N, 34NW, 35N, 38N, 39N, 46N, 49N, 53N, 55N, and 62NW.

Station number, name, and drainage area of 62 sites

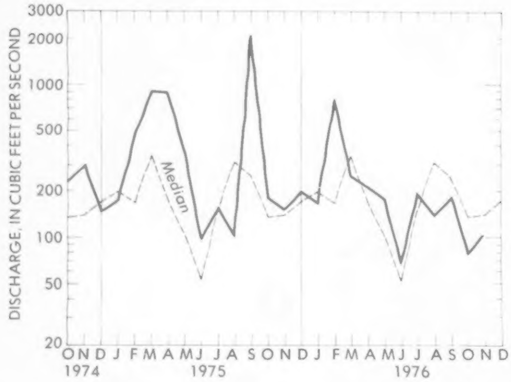
Number on map	USGS station number	Site	Drainage area (sq mi)	Average discharge; years of record (cfs)	Within hydrologic cataloging unit--
1N	06054500	Missouri River at Toston, Mont.	14,669	5,349/40	10030101
2W	06099500	Marias River near Shelby, Mont	3,242	960/67	10030203
3N	06109500	Missouri River at Virgelle, Mont	34,379	8,523/40	10040101
4N	06130500	Musselshell River at Mosby, Mont	7,846	265/43	10040205
5N	06132000	Missouri River below Fort Peck Dam, Mont	57,556	9,662/32	10060001
6N	06174500	Milk River at Nashua, Mont	22,332	706/36	10050012
7N	06185500	Missouri River near Culbertson, Mont	91,557	10,500/25	10060005
8W	06191500	Yellowstone River at Corwin Springs, Mont	2,623	3,123/69	10070002
9NW	06214500	Yellowstone River at Billings, Mont	11,795	6,986/47	10070004
10B	06288200	Beauvais Creek near St. Xavier, Mont	100	25.8/8	10080015
11N	06294700	Bighorn River at Bighorn, Mont	22,885	3,953/30	10080015
12W	06298000	Tongue River near Dayton, Wyo	204	189/46	10090101
13N	06308500	Tongue River at Miles City, Mont	5,379	442/32	10090102
14N	06326500	Powder River near Locate, Mont	13,194	622/37	10090209
15N	06329500	Yellowstone River near Sidney, Mont	69,103	13,140/63	10100004
16B	06332515	Bear Den Creek near Mandaree, N. Dak	74	10.4/9	10110101
17N	06337000	Little Missouri River near Watford City, N. Dak	8,310	605/41	10110205
18N	06338490	Missouri River at Garrison Dam, N. Dak	181,400	26,930/6	10130101
19N	06340500	Knife River at Hazen, N. Dak	2,240	181/42	10130201
20NW	06354000	Cannonball River at Breien, N. Dak	4,100	245/41	10130206
21N	06357800	Grand River at Little Eagle, S. Dak	5,370	239/17	10130303
22B	06409000	Castle Creek above Deerfield Reservoir, near Hill City, S. Dak	83	10.1/27	10120110
23N	06438000	Belle Fourche River near Elm Springs, S. Dak	7,210	365/44	10120202
24N	06439300	Cheyenne River at Cherry Creek, S. Dak	23,900	858/15	10120112
25N	06440000	Missouri River at Pierre, S. Dak	243,500	21,860/36	10140101
26W	06441500	Bad River near Fort Pierre, S. Dak	3,107	151/47	10140102
27N	06452000	White River near Oacoma, S. Dak	10,200	527/47	10140204
28N	06453000	Missouri River at Fort Randall Dam, S. Dak	263,500	24,700/28	10170101
29W	06454500	Niobrara River above Box Butte Reservoir, Nebr	1,400	30.8/29	10150002
30N	06465500	Niobrara River near Verdel, Nebr	12,600	1,532/18	10150007
31	06467500	Missouri River at Yankton, S. Dak	279,500	25,770/45	10170101
32N	06478500	James River near Scotland, S. Dak	21,550	377/47	10160011
33B	06478540	Little Vermillion River near Salem, S. Dak	51.0	1.82/9	10170102
34NW	06485500	Big Sioux River at Akron, Iowa	9,030	842/47	10170203
35N	06486000	Missouri River at Sioux City, Iowa	314,600	31,910/78	10230001
36B	06623800	Encampment River above Hog Park Creek, near Encampment, Wyo	72.7	114/11	10180002
37W	06630000	North Platte River above Seminoe Reservoir, near Sinclair, Wyo	8,134	1,114/36	10180002
38N	06686000	North Platte River at Lisco, Nebr	30,700	1,315/34	10180009
39N	06764000	South Platte River at Julesburg, Colo	23,138	486/73	10190018
40B	06775900	Dismal River near Thedford, Nebr	960	191/9	10210002
41N	06792499	Loup River power canal at diversion near Genoa, Nebr	....	1,564/37	10210009
42	06792500	Loup River power canal near Genoa, Nebr	....	1,564/37	10210009
43	06793000	Loup River near Genoa, Nebr	14,400	565/31	10210009
44N	06796000	Platte River at North Bend, Nebr	81,100	4,048/26	10200201
45W	06800500	Elkhorn River at Waterloo, Nebr	6,900	1,138/55	10220003
46N	06805500	Platte River at Louisville (near South Bend), Nebr	89,800	5,742/22	10200202
47N	06807000	Missouri River at Nebraska City, Nebr	414,400	34,960/46	10240001
48W	06810000	Nishnabotna River above Hamburg, Iowa	2,806	1,022/48	10240004
49N	06818000	Missouri River at St. Joseph, Mo	424,300	38,710/47	10240011
50N	06856600	Republican River at Clay Center, Kans	24,542	1,034/58	10250017
51W	06867000	Saline River near Russell, Kans	1,502	119/24	10260009
52N	06877600	Smoky Hill River at Enterprise, Kans	19,260	1,653/41	10260008
53W	06884400	Little Blue River near Barnes, Kans	3,324	657/17	10270207
54N	06887000	Big Blue River near Manhattan, Kans	9,640	1,944/21	10270205
55N	06892350	Kansas River at De Soto (formerly at Bonner Springs), Kans	59,756	6,935/58	10270104
56W	06897500	Grand River near Gallatin, Mo	2,250	1,141/54	10280101
57B	06897950	Elk Creek near Decatur City, Iowa	52.5	32.4/8	10280102
58N	06902000	Grand River near Sumner, Mo	6,880	3,796/52	10280103
59	06926500	Osage River near St. Thomas, Mo	14,500	10,230/44	10290111
60N	06926510	Osage River below St. Thomas, Mo	14,500	....	10290111
61W	06933500	Gasconade River at Jerome, Mo	2,840	2,537/55	10290203
62NW	06934500	Missouri River at Hermann, Mo	528,200	79,750/78	10300200
		Hydrologic bench-mark station in Hudson Bay basin, in Montana[a]			
.....	05014500	Swiftcurrent Creek at Many Glacier, Mont	30.9	148/19	10010002

[a]The station, 5 miles east of Continental Divide, is about 90 miles west-northwest of site 2W. The creek is tributary to Saint Mary River.

(Additional table, lower half of page 10.)

(Continued from page 7.)

percent of the November median but was within the normal range. (See graph.)



Monthly mean discharge of Gila River at head of Safford Valley, near Solomon, Ariz. (Drainage area, 7,896 sq mi; 20,451 sq km)

In Utah, streamflow was below median at all index stations in the State, and was below the normal range except at Colorado River near Cisco and Green River at Green River, which were within the normal range. In southwestern Utah, the monthly mean discharge of 12.4 cfs in Beaver River near Beaver (drainage area, 90.7 square miles) was a new monthly minimum for the 2d consecutive month.

Monthly mean discharge at the index stations in Colorado decreased seasonally and was generally in the below-normal range, except in Arkansas River at Canon City, where flow decreased contraseasonally but remained in the above-normal range as a result of releases from Twin Lakes Reservoir and Turquoise Lake.

In Idaho, streamflow at the index station, Snake River near Heise, decreased seasonally and was in the below-normal range as a result of below-normal precipitation and above-normal temperatures. Streamflow in the remainder of the State was generally in the normal range.

In northwestern Montana, monthly mean discharges of Marias River near Shelby and Middle Fork Flathead River near West Glacier remained in the below-normal range, while flows elsewhere in the State were generally in the normal range.

In Alberta and British Columbia, streamflow decreased seasonally and was below the normal range in the Athabasca River basin as measured at Hinton, Alberta, and above the normal range in the Skeena River basin as measured at Usk, British Columbia.

Contents of major reservoirs in the Colorado-Big Thompson project in Colorado were below-normal. Contents of the Colorado River Storage Project decreased 618,300 acre-feet during the month.

Ground-water levels in eastern Washington declined and were below average; in western Washington, levels were above average. The level in the well in the sand and gravel aquifer near Boise, Idaho, continued to decline, but was still slightly above average. A decline of a little more than a foot was noted in the well at Gooding in central Snake River Plain, and the level continued below average; levels in other wells showed little definite trend.

SELECTED DATA FOR SOME KEY STREAM STATIONS IN THE MISSOURI REGION—Continued

Mean and extreme discharges at thirteen long-term stream-gaging stations

Number on map	Stream	Maximum discharge; month-year (cfs)	Minimum discharge; month-year (cfs)	Average discharge; 1941–70 (cfs)	Average discharge (1941–70) by months, expressed as percent of average discharge for entire 30-water-year period (percent)											
					Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1N	Missouri	32,000/6-48	562/4-41	5,082	66	72	78	110	165	241	97	49	65	83	91	74
9NW	Yellowstone	69,500/6-74	430/12-32	7,283	34	39	42	57	170	372	204	76	59	55	50	40
14N	Powder	31,000/2-43	(a)/...	616	19	73	216	140	184	318	107	36	26	32	28	23
15N	Yellowstone	159,000/6-21	470/5-61	12.470	42	53	88	83	135	320	189	64	57	65	59	45
17N	Little Missouri	110,000/3-47	(b)/...	582	1	39	310	331	114	217	91	39	32	16	8	2
27N	White	51,900/3-52	(c)/...	605	11	30	244	168	231	268	98	52	34	26	21	13
34NW	Big Sioux	80,800/4-69	7/2-36	976	11	50	188	345	130	186	110	63	45	32	26	17
37W	North Platte	14,500/6-57	70/9-44	1,082	27	29	42	137	280	396	116	43	27	36	36	30
45W	Elkhorn	100,000/6-44	50/11-40	1.257	39	76	173	150	142	248	104	77	54	51	47	41
50N	Republican	195,000/6-35	0/8-34	1.124	35	63	85	96	141	257	185	87	107	70	41	32
55N	Kansas	510,000/7-51	160/10-56	8,132	35	54	90	114	133	233	192	87	99	81	46	36
58N	Grand	180,000/6-47	10/8-34	3,853	54	93	150	170	138	242	105	45	71	49	56	33
62NW	Missouri	[d]676,000/6-03	4,200/1-40	76,240	49	67	106	156	139	166	142	83	90	83	72	47

[a]No flow at times in January and February 1950; July, September, and October 1960; and in September 1961.

[b]No flow at times in most years.

[c]No flow August 14–28, 1971, and July 16–23, 1974.

[d]Maximum discharge known, about 892,000 cfs, flood of June 1844.

CORRECTIONS IN OCTOBER ISSUE--

Page 11: In last column, second item, the number should be 1-4845.5 instead of 1-485.5.

Page 14: The site numbers of sites 6W, 10N, 41, and 46NW are not shown on the map. Site 6W is at the unnumbered triangle symbol in Michigan's Upper Peninsula, east of site 5N. Site 10N is in the vicinity of site 9, 41 in vicinity of 42N, and 46NW north of 47N (on Canadian side of international boundary).

Page 15: Last column of first table, site 39 (Niagara River at Buffalo, N.Y.) is within hydrologic unit 04120103. In footnote "b" at bottom of page, the correct date is March 18, 1865 instead of March 18, 1965.

In Rathdrum Prairie in northern Idaho the level in the observation well declined 1.2 feet but continued more than a foot above average. In Montana, levels declined and were somewhat below average except in the area northeast of the Missouri River, where levels generally rose and were about average. In southern California, the level in the observation well in alluvium in the Santa Maria Valley rose more than 8 feet, and the level in the artesian well in the Lompoc area, in the Santa Ynez Valley, rose 1.5 feet; a rise of less than a foot was noted in the Baldwin Park area. Levels in the other index wells declined, and end-of-month levels in all index wells continued below average. In Nevada, levels rose and were above average in Paradise Valley, rose but were below average in Las Vegas Valley, and declined and were below average in Truckee Meadows, where the key well reached a new low for November in 19 years of record. Levels in Utah generally rose throughout most of the State except in the Blanding and Logan areas, where slight declines occurred. Levels continued below average in the Flowell and Holladay areas and above average in the Balding and Logan areas. In Arizona, water levels both rose and declined in index wells during the month. New November lows occurred in wells at Tucson, Avra Valley, Elfrida, and Western Salt River Valley; a new November high was observed at the Nogales well. In southern New Mexico, slight or only moderate rises occurred in the observation wells during the month; the level in the Berrendo-Smith observation well in the Pecos Valley was nearly 5 feet below that for November 1975. New November lows were recorded at that well and at the well in the shallow aquifer in the southern part of the Roswell basin.

ALASKA

Streamflow receded seasonally throughout the State. In the Chena River basin, monthly mean flow as measured at Fairbanks remained in the below-normal range for the 6th consecutive month. On Kenai River at Cooper Landing, in the south-coastal part of the State, monthly mean flow was fourth highest in 29 years of record and in the above-normal range. Elsewhere in the State, flows were generally in the normal range.

Ground-water levels in wells tapping confined aquifers in the Anchorage area generally rose south of the city center and fell an average of two feet north and east of the main pumping center, generally along Ship Creek. The water level of the alluvial aquifers remained stable during November.

HAWAII

Streamflow generally increased seasonally in the eastern part of the State as a result of rains that occurred at mid-month and flows were in the normal range. Monthly mean flows in western Hawaii on the islands of Kauai and Oahu decreased contraseasonally and were generally below the normal range.

NEW PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

The U.S. Geological Survey has published two new manuals and one revised manual in the series on "Techniques of Water-Resources Investigations," since the list of all reports in this series was shown on pages 7 and 8 of the May 1976 issue of the Water Resources Review. The revised manual (with new title and price) is Book 7, Chapter C1; and the new manuals are Book 1, Chapter D2, and Book 3, Chapter B2.

Thirty-three manuals by the U.S. Geological Survey have been published to date in the series on techniques describing procedures for planning and executing specialized work in water-resources investigations. The information in the manual series is grouped under major subject headings called books and is further divided into sections and chapters. For example, Section B of Book 3 (Applications of hydraulics) is on ground-water techniques. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises.

The reports may be purchased from Branch of Distribution, U.S. Geological Survey, 1200 S. Eads St., Arlington, VA 22202 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

NOTE: When ordering any of these publications, please give the title, book number, chapter number, and "U.S. Geological Survey Techniques of Water-Resources Investigations."

1–D2. *Guidelines for collection and field analysis of ground-water samples for selected unstable constituents;* by W. W. Wood: USGS—TWRI Book 1, Chapter D2. 1976. 24 pages. $0.85.

3–B2. *Introduction to ground-water hydraulics—A programed text for self-instruction,* by G.D. Bennett: USGS—TWRI Book 3, Chapter B2. 1976. 172 pages. $2.50.

7–C1 *Finite-difference model for aquifer simulation in two dimensions with results of numerical experiments,* by P.C. Trescott, G.F. Pinder, and S.P. Larson: USGS—TWRI Book 7, Chapter C1. 1976. 116 pages. $2.30.

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR NOVEMBER AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	November data of following calendar years	Stream discharge during month: Mean (cfs)	Dissolved-solids concentration during month[a]: Minimum (mg/L)	Dissolved-solids concentration during month[a]: Maximum (mg/L)	Dissolved-solids discharge during month[a] (tons per day): Mean	Dissolved-solids discharge during month[a] (tons per day): Minimum	Dissolved-solids discharge during month[a] (tons per day): Maximum	Water temperature during month[b]: Mean, in °C	Water temperature during month[b]: Minimum, in °C	Water temperature during month[b]: Maximum, in °C
	NORTHEAST										
01463500	Delaware River at Trenton, N.J. (Morrisville, Pa.)	1976*	11,060	....	....	......	....	....	.....	.....	......
		1944–75	10,290	55 (Nov. 1–10, 1955)	151 (Nov. 15, 1964)	......	469 (Nov. 6, 1963)	12,300 (Nov. 10, 1972)	.....	2.0	19.0
			[9,024[c]]								
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, N.Y. (streamflow station formerly at Ogdensburg, N.Y.)	1976	297,000	166	167	133,000	128,000	135,000	6.5	5.0	8.0
		1975	287,400	167	167	130,000	126,000	132,000	10.5	8.0	12.0
		1966–75	265,400	....	....	......	....	....	9.0	5.5	14.5
			[228,000[c]]								
	SOUTHEAST										
07289000	Mississippi River at Vicksburg, Miss	1976	299,500	201	227	175,000	123,000	220,000	9.5	8.0	12.5
		1975	430,400	204	224	256,000	221,000	322,000	16.5	14.0	18.0
			[291,300[c]]								
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill. (25 miles west of Paducah, Ky.; streamflow station at Metropolis, Ill.)	1976	158,300	167	245	......	41,100	174,600	.....	8.0	13.5
		1954–75	159,200	129 (Nov. 21, 1957)	425 (Nov. 25, 1968)	......	27,200 (Nov. 22, 1954)	406,000 (Nov. 23, 1957)	.....	1.0	19.5
			[120,800[c]]								
	MIDCONTINENT										
06934500	Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1976	45,800	362	448	51,200	43,600	58,700	6.5	5.0	10.0
		1975	80,600	418	465	97,400	88,600	115,000	10.5	4.5	15.0
			[43,700[c]]								
	WEST										
14128910	Columbia River at Warrendale, Oreg. (30 miles east of Portland, Oreg.; streamflow station at The Dalles, Oreg.)	1976	130,100	85	102	32,300	26,800	39,000	12.0	11.0	13.0
		1975	147,000	103	113	42,900	31,200	60,100	13.0	11.0	14.5
		1967–75		....	....	......	....	....	.....	7.0	14.5
			[106,500[c]]								

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.
*Dissolved-solids and water-temperature data not available.

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF NOVEMBER 1976

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir — Principal uses: F–Flood control; I–Irrigation; M–Municipal; P–Power; R–Recreation; W–Industrial

Reservoir	End of Oct. 1976	End of Nov. 1976	End of Nov. 1975	Average for end of Nov.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	45	52	28	38	226,300 (a)
QUEBEC					
Allard (P)	91	83	93	92	280,600 ac-ft
Gouin (P)	83	81	84	102	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	91	86	56	55	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	63	74	51	76	3,330 mcf
Lake Francis (FPR)	90	75	92	78	4,326 mcf
Lake Winnipesaukee (PR)	75	76	87	56	7,200 mcf
VERMONT					
Harriman (P)	73	64	73	64	5,060 mcf
Somerset (P)	80	77	89	70	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	74	72	80	72	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	78	68	63	55	34,270 mcf
Indian Lake (FMP)	106	90	82	58	4,500 mcf
New York City reservoir system (MW)	86	92	96	...	547,500 mg
NEW JERSEY					
Wanaque (M)	83	85	100	67	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	33	28	33	32	51,400 mcf
Pymatuning (FMR)	88	81	92	78	8,191 mcf
Raystown Lake (FR)	63	62	56	29	33,190 mcf
Lake Wallenpaupack (PR)	72	68	74	50	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	98	97	100	84	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	88	80	93	75	12,580 mcf
Narrows (Badin Lake) (P)	98	98	97	92	5,617 mcf
High Rock Lake (P)	75	64	72	55	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	83	82	67	57	70,300 mcf
Lakes Marion and Moultrie (P)	95	82	76	60	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	69	73	70	49	75,360 mcf
GEORGIA					
Burton (PR)	83	77	77	54	104,000 ac-ft
Sinclair (MPR)	80	89	73	69	214,000 ac-ft
Lake Sidney Lanier (FMPR)	54	54	63	47	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	83	78	79	58	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	38	34	33	30	1,156,000 cfsd
Douglas Lake (FPR)	38	21	27	15	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	53	41	50	40	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	49	44	42	32	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	35	26	47	39	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	64	63	93	74	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	21	19	60	63	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	11	10	23	28	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	89	87	92	......	22,640,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	60	61	61	73	127,600 ac-ft
Bell Fourche (I)	11	19	36	40	185,200 ac-ft
Lake Francis Case (FIP)	66	53	51	50	4,834,000 ac-ft
Lake Oahe (FIP)	80	81	81	......	22,530,000 ac-ft
MIDCONTINENT REGION--Continued					
SOUTH DAKOTA--Continued					
Lake Sharpe (FIP)	103	102	101	91	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	95	92	95	91	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	66	68	73	68	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	72	68	78	93	2,378,000 ac-ft
Keystone (FPR)	66	66	74	106	661,000 ac-ft
Tenkiller Ferry (FPR)	78	75	96	101	628,200 ac-ft
Lake Altus (FIMR)	56	55	90	45	134,500 ac-ft
Lake O'The Cherokees (FPR)	72	73	72	81	1,492,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	90	89	92	92	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	86	91	90	42	386,400 ac-ft
Canyon (FMR)	94	99	92	64	385,600 ac-ft
International Amistad (FIMPW)	101	104	100	72	3,497,000 ac-ft
International Falcon (FIMPW)	100	100	98	76	2,667,000 ac-ft
Livingston (IMW)	100	100	98	70	1,788,000 ac-ft
Possum Kingdom (IMPRW)	93	94	93	101	569,400 ac-ft
Red Bluff (PI)	21	21	36	29	307,000 ac-ft
Toledo Bend (P)	88	81	85	75	4,472,000 ac-ft
Twin Buttes (FIM)	92	97	97	16	177,800 ac-ft
Lake Kemp (IMW)	68	78	84	89	268,000 ac-ft
Lake Meredith (FMW)	41	40	45	38	821,300 ac-ft
Lake Travis (FIMPRW)	91	99	92	76	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	97	86	89	78	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	94	89	93	96	5,232,000 ac-ft
Lake Chelan (PR)	80	65	77	64	676,100 ac-ft
Lake Cushman	81	71	98	84	359,500 ac-ft
Lake Merwin (P)	97	105	105	89	246,000 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	54	58	61	53	1,235,000 ac-ft
Coeur d'Alene Lake (P)	54	36	49	54	238,500 ac-ft
Pend Oreille Lake (FP)	44	32	40	53	1,561,000 ac-ft
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	58	62	67	56	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	92	89	87	79	802,000 ac-ft
Buffalo Bill (IP)	68	66	69	72	421,300 ac-ft
Keyhole (F)	66	65	67	39	199,900 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	55	56	61	44	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	0	1	0	13	364,400 ac-ft
Taylor Park (IR)	61	60	67	53	106,200 ac-ft
Colorado–Big Thompson project (I)	49	48	71	56	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	78	76	80	......	31,280,000 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	79	77	78	56	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	42	40	65	51	1,000,000 ac-ft
Hetch Hetchy (MP)	28	22	60	40	360,400 ac-ft
Isabella (FIR)	13	12	31	21	551,800 ac-ft
Pine Flat (FI)	23	24	44	38	1,014,000 ac-ft
Clair Engle Lake (Lewiston) (P)	55	51	76	73	2,438,000 ac-ft
Lake Almanor (P)	55	56	81	45	1,036,000 ac-ft
Lake Berryessa (FIMW)	64	63	85	76	1,600,000 ac-ft
Millerton Lake (FI)	46	46	48	38	503,200 ac-ft
Shasta Lake (FIPR)	33	36	77	65	4,377,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	37	33	74	47	744,600 ac-ft
NEVADA					
Rye Patch (I)	64	63	83	73	157,200 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	79	81	77	67	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	0	0	13	12	1,073,000 ac-ft
Salt and Verde River system (IMPR)	48	48	50	33	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	24	24	23	75	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	14	15	24	25	2,539,000 ac-ft

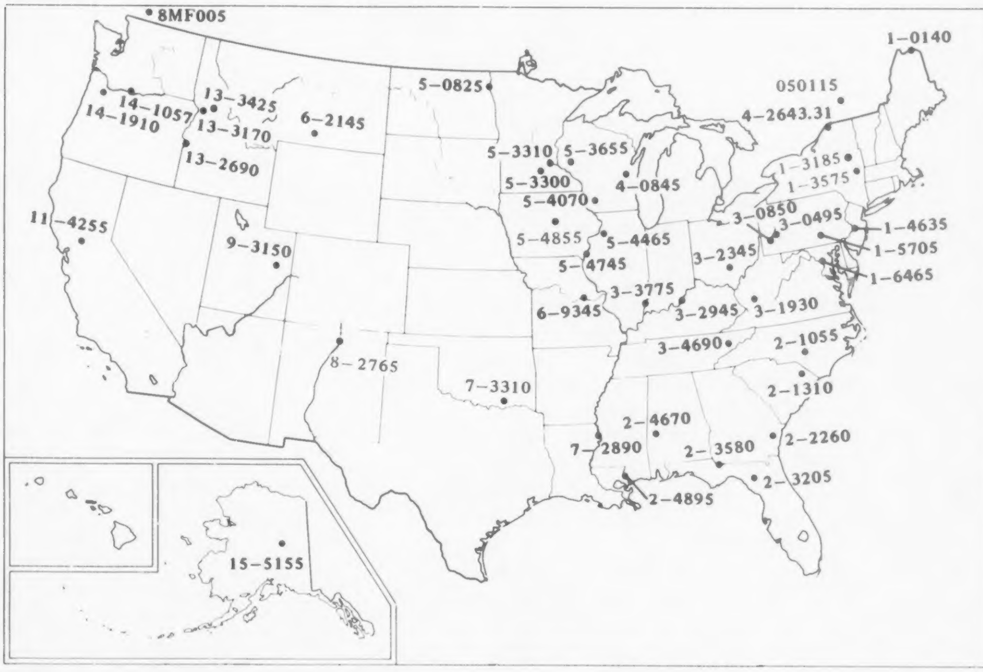
[a] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

FLOW OF LARGE RIVERS DURING NOVEMBER 1976

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	November 1976					
				Monthly discharge (cfs)	Percent of median monthly discharge, 1941–70	Change in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1–0140	St. John River below Fish River at Fort Kent, Maine.	5,690	9,397	10,970	155	-20	5,100	3,300	30
1–3185	Hudson River at Hadley, N.Y	1,664	2,791	3,330	166	-30	1,500	970	29
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,450	5,450	146	-38	....	....	....
1–4635	Delaware River at Trenton, N.J	6,780	11,360	11,174	124	-39	5,540	3,580	28
1–5705	Susquehanna River at Harrisburg, Pa.	24,100	33,670	33,150	158	-57	15,400	9,950	30
1–6465	Potomac River near Washington, D.C.	11,560	[1] 10,640	11,200	269	-67	6,490	4,190	30
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	4,847	1,591	68	-32	2,420	1,560	30
2–1310	Pee Dee River at Peedee, S.C	8,830	9,098	6,900	153	-42	4,830	3,120	28
2–2260	Altamaha River at Doctortown, Ga.	13,600	13,380	8,852	189	-27	10,300	6,660	25
2–3205	Suwannee River at Branford, Fla	7,740	6,775	5,160	120	+10	6,490	4,190	29
2–3580	Apalachicola River at Chattahoochee, Fla.	17,200	21,690	18,500	173	+19	67,200	43,400	30
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	21,700	4,650	80	+62	4,950	3,200	29
2–4895	Pearl River near Bogalusa, La	6,630	8,533	2,475	108	+63	4,700	3,040	30
3–0495	Allegheny River at Natrona, Pa	11,410	[1] 18,700	14,370	138	-28	8,350	5,400	28
3–0850	Monongahela River at Braddock, Pa.	7,337	[1] 11,950	10,020	156	-52	3,750	2,420	28
3–1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,370	10,550	160	-58	7,690	4,970	28
3–2345	Scioto River at Higby, Ohio	5,131	4,337	1,552	137	+30	1,120	720	26
3–2945	Ohio River at Louisville, Ky[2]	91,170	110,600	67,340	152	-36	38,700	25,000	27
3–3775	Wabash River at Mount Carmel, Ill.	28,600	26,310	5,106	68	+9	5,040	3,260	30
3–4690	French Broad River below Douglas Dam, Tenn.	4,543	[1] 6,528	3,102	89	-53	....	....	....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,142	2,250	79	+190	....	....	....
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[3]	299,000	239,100	296,500	130	-2	285,000	184,000	30
050115	St. Maurice River at Grand Mere, Quebec.	16,300	24,900	11,500	56	-42	29,000	18,700	29
5–0825	Red River of the North at Grand Forks, N. Dak.	30,100	2,439	303	27	-23	250	160	30
5–3300	Minnesota River near Jordan, Minn ..	16,200	3,306	212	25	+5	190	120	26
5–3310	Mississippi River at St. Paul, Minn ...	36,800	[1] 10,230	1,722	32	+22	2,250	1,450	25
5–3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,062	1,000	28	+26	....	....	....
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,457	2,871	48	+6	....	....	....
5–4465	Rock River near Joslin, Ill	9,520	5,288	2,040	71	+12	2,490	1,610	29
5–4745	Mississippi River at Keokuk, Iowa ...	119,000	61,210	17,620	48	+7	14,300	9,240	30
5–4855	Des Moines River below Raccoon River at Des Moines, Iowa.	9,879	3,796	142	16	-18	70	45	30
6–2145	Yellowstone River at Billings, Mont.	11,795	6,754	3,917	109	-24	3,400	2,200	30
6–9345	Missouri River at Hermann, Mo	528,200	78,480	44,270	101	-9	43,500	28,100	24
7–2890	Mississippi River at Vicksburg, Miss.[4]	1,144,500	552,700	299,500	103	+11	196,000	127,000	30
7–3310	Washita River near Durwood, Okla ..	7,202	1,379	227	51	+27	185	120	30
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex.	9,730	732	337	80	+26	340	220	23
9–3150	Green River at Green River, Utah ...	40,600	6,369	1,909	76	+13	3,500	2,260	30
11–4255	Sacramento River at Verona, Calif ...	21,257	18,370	6,730	58	-8	7,050	4,560	24
13–2690	Snake River at Weiser, Idaho	69,200	17,670	15,640	110	-5	16,400	10,600	26
13–3170	Salmon River at White Bird, Idaho ..	13,550	11,060	5,452	106	-9	5,010	3,240	26
13–3425	Clearwater River at Spalding, Idaho ..	9,570	15,320	6,528	121	+45	9,150	5,910	26
14–1057	Columbia River at The Dalles, Oreg.[5]	237,000	194,000	129,800	122	-8	....	....	....
14–1910	Willamette River at Salem, Oreg	7,280	23,370	12,940	47	+7	13,240	8,560	26-30
15–5155	Tanana River at Nenana, Alaska	25,600	24,040	8,673	109	-33	7,800	5,040	29
8MF005	Fraser River at Hope, British Columbia.	83,800	95,300	63,400	106	-29	56,100	36,300	29

[1] Adjusted.
[2] Records furnished by Corps of Engineers.
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5] Discharge (unadjusted) determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.
*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

SELECTED STREAM-GAGING STATIONS ON LARGE RIVERS



Location of stream-gaging stations on large rivers listed in table on page 14.

WATER RESOURCES REVIEW

NOVEMBER 1976

Based on reports from the Canadian and U.S. field offices; completed December 9, 1976

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EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for November based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for November 1976 is compared with flow for November in the 30-year reference period 1931–60 or 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for November is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range.* In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the November flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of November. Water level in each key observation well is compared with average level for the end of November determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels,* unless described otherwise, are from the end of October to the end of November.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

AN APPRAISAL OF GROUND WATER FOR IRRIGATION IN THE APPLETON AREA, WEST-CENTRAL MINNESOTA

The abstract and accompanying map and graph are from the report, *An appraisal of ground water for irrigation in the Appleton area, west-central Minnesota,* by Steven P. Larsen: U.S. Geological Survey Water-Supply Paper 2039-B, 34 pages, 1976; prepared in cooperation with the Wesmin Resource Conservation and Development Project Committee and the Minnesota Department of Natural Resources, Division of Waters, Soils, and Minerals. The report may be purchased for $2.60 from Branch of Distribution, U.S. Geological Survey, 1200 S. Eads St., Arlington, VA 22202 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (GPO Stock Number 024-001-02870-1), payable to Superintendent of Documents.

ABSTRACT

Supplemental irrigation of well-drained sandy soils has prompted an evaluation of ground water in the Appleton area (fig. 1). Glacial drift aquifers are the largest source of ground water. The surficial outwash sand and gravel is the most readily available and the most areally extensive drift aquifer, and it underlies much of the sandy soil area. Saturated thickness of the outwash is more than 80 feet (24 m) in places, and potential well yields may exceed 1,200 gal/min (76 l/s) in some areas. In about 17 percent of the area, yields of more than 300 gal/min (19 l/s) are obtainable.

Recharge to the outwash aquifer occurs primarily during the spring thaw (fig. 2) and averages about 5 inches (12.7 cm) annually. Most discharge from the aquifer appears as base flow in the Pomme de Terre River. Despite dissolved-solids concentrations ranging from 280 to 1,350 mg/l, the water is chemically suitable for irrigation.

Mathematical models of a part of the aquifer were made to evaluate the effects of 20 successive years of ground-water withdrawal for three irrigation-development patterns. It was estimated that the present annual withdrawal rate of 1,410 acre-ft (1.74 hm^3) would result in water-level declines of less than 3 feet (0.9 m). However, annual withdrawals of 8,450 acre-ft (10.4 hm^3) would cause aquifer dewatering and decreased well yields in some places. After a new state of equilibrium was established in response to withdrawals, most of the withdrawal would be supplied by diverted base flow from the Pomme de Terre River.

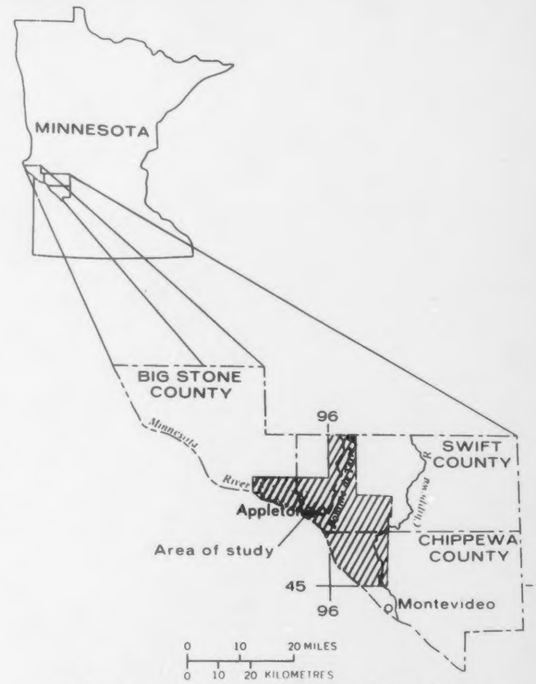
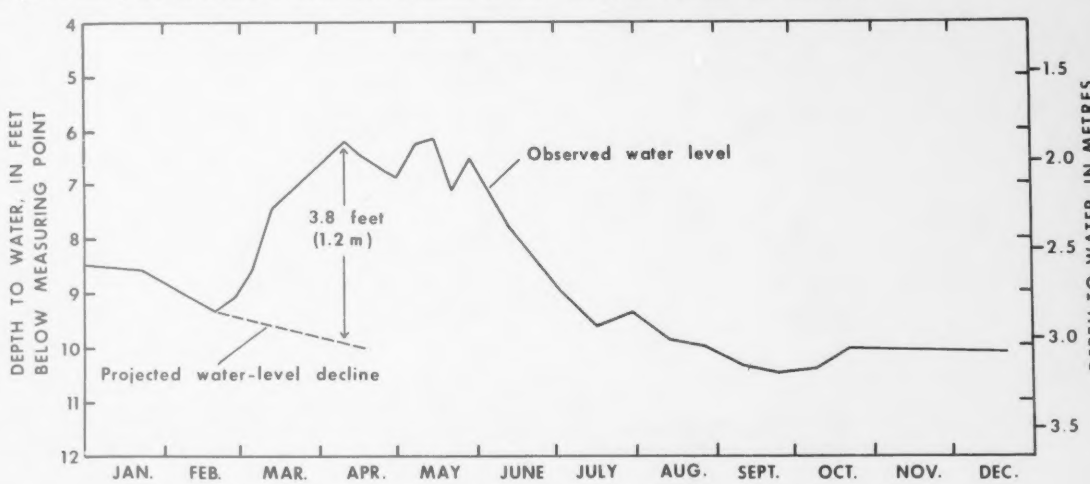


Figure 1.—Location and extent of the Appleton area.



Hydrograph for observation well 120.42.4ddd

Recharge (due largely to snowmelt and early spring rain) = (water-level rise) x (estimated specific yield)

= 3.8 feet (1.2 m) x 0.14

= 0.53 foot (0.16 m)

= 6.4 inches (16.3 cm)

Figure 2.—Example of hydrograph showing method of estimating recharge during the spring of the surficial aquifer in the Appleton area.